OXFORD

BioScience, 2025, **75**, 240–250
https://doi.org/10.1093/biosci/biae127
Advance access publication date: 3 February 2025
Forum

Expanding the historical baseline: using pre-modern archives to inform conservation from ecological and human perspectives

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Abstract

Conservation practitioners are increasingly aware of historical biodiversity change and the importance of environmental archives, which include both specimen-based and document-based materials spanning a range of resolutions and contexts. The incorporation of written records into conservation planning typically involves documents with a biological focus from the modern and early modern periods (sixteenth century onward, and mainly the nineteenth and twentieth centuries). Extensive older pre-modern document-based archives are not traditionally used as conservation evidence. However, this data type can provide unique insights into past human–environment interactions, including biotic states and change, cultural interactions with nature, and human dimensions of social–ecological systems that involved rural communities closely dependent on biodiversity. Multicentury archives can also track the long-term consequences of human activities. Incorporation of pre-modern baselines into conservation is hindered by conceptual and logistical barriers, and increased interdisciplinary collaboration between environmental sciences and the humanities is needed to promote awareness and use of conservation-relevant insights.

Keywords: conservation evidence, ecological records, environmental change, historical ecology, social–ecological systems

Effective conservation management requires an evidence-based approach, whereby decision-making is underpinned by empirical data on conservation-relevant parameters (Sutherland et al. 2004, Segan et al. 2011). This evidence includes robust baselines on biodiversity states and change, such as the status, trends, and threats of priority species and ecosystems (Svancara et al. 2005, Salafsky et al. 2019, Ingram et al. 2020). Conservation typically takes place in linked biocultural or social–ecological systems containing human and nonhuman actors and processes. Conservation-relevant information is therefore also required about the dynamics, drivers, and sustainability of different human–environment interactions across varying sociocultural and economic contexts, stakeholder attitudes and values toward different components of biodiversity, and the effectiveness of past actions that aimed to preserve species or landscapes (Gavin et al. 2015, Miller et al. 2023). Such baselines are integral to identifying strategies that can maintain both biodiversity and human well-being, and to providing predictive power for understanding future risk.

Most of the information used for conservation research and management consists of ecological data sets collected by trained conservation professionals (Mihoub et al. 2017, Stephenson and Stengel 2020). There is also increasing use of complementary data sources associated with the human dimensions of social–ecological systems, derived from a variety of social science disciplines, including human geography, anthropology, economics, political science, psychology, and sociology (Bennett et al. 2017, Miller et al. 2023). The recognition that conservation requires more perspectives from the humanities highlights the core conservation importance of data sources such as Indigenous ecological knowledge (Kimmerer 2000), a body of knowledge that can be used to understand local environmental perceptions, human–wildlife dynamics, and management practices, and that can promote the incorporation of local values and needs into fair and ethical environmental governance (Wilder et al. 2016, Berkes 2018, Kadykalo et al. 2021).

Conservation planning is almost exclusively informed by modern data and recent environmental states. Even among studies that are regarded as "long-term" by ecologists, few data sets are older than 100 years (Bonebrake et al. 2010). National and international conservation planning frameworks also typically set relatively recent historical baselines for interpreting "natural" biodiversity conditions and human-caused depletion. For example, 1500 CE, a date that corresponds approximately with the onset of European colonial expansion around the globe and its resultant ecological impacts (Watts 1987, Gerbi 2010), has been widely used as a temporal baseline for considering species extinctions and population declines (e.g., MacPhee and Flemming 1999). In particular, this date is used by the International Union for Conservation of Nature as the threshold for assessing extinction, risk, and depletion in its Red List of Threatened Species and Green Status assessments, which represent global benchmarks for evaluating human-caused biodiversity loss (Grace et al. 2021, IUCN 2024).

However, anthropogenic activities have affected natural systems for much longer than the recent past. There is evidence for human-caused biodiversity loss and environmental change across multicentury and multimillennial scales for nearly all global systems (Boivin et al. 2016, Turvey and Crees 2019). Without a good understanding of older historical baselines about

Received: May 2, 2024. **Revised:** October 22, 2024. **Accepted:** November 22, 2024
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biodiversity change, including species' vulnerability and resilience to different pressures and the varying sustainability of past human relationships with natural landscapes, it is likely that fundamental patterns of ecology, biogeography, and extinction risk can be misunderstood. These oversights often have important real-world consequences for planning and management (Szabó and Hédl 2011, McClenachan et al. 2012, Rick and Lockwood 2012, Barnosky et al. 2017). In addition to modern sources of ecological knowledge, it is therefore essential to also incorporate information from long-term environmental archives into conservation thinking.

Here, we aim to highlight the conservation relevance and usefulness of written records dating from before 1500 CE, representing the so-called pre-modern historical period. These documentary archives contain abundant information about the ecological and human dimensions of past social–ecological systems but are often overlooked by modern ecologists, conservation scientists, managers, and policymakers. We identify factors that may currently limit the use of these records by environmental researchers and practitioners, as well as potential solutions to support increased interdisciplinary collaboration and integration of pre-modern documentary archives into conservation science and planning.

Using historical evidence in conservation

A variety of different archives, which span a range of temporal resolutions and environmental contexts, has been investigated from a conservation standpoint to understand past biodiversity states. Several related academic disciplines now exist to promote research in this field, including conservation palaeobiology, historical ecology, landscape ecology, applied zooarchaeology, and restoration ecology (Dietl et al. 2015, Szabó 2015, Turvey and Saupe 2019). This approach has led to the development of new conservation assessment and prioritization frameworks that explicitly assess change against historical baselines (Grace et al. 2019, Rodrigues et al. 2019) and has provided evidence to inform real-world management, including species reintroduction, ecosystem restoration, and rewilding (Willis et al. 2010, Griffiths et al. 2011, Alagona et al. 2012). Consideration of conservation concerns from a past-based perspective has also prompted new awareness of important concepts such as shifting baseline syndrome, whereby the loss of information about former environmental conditions leads to mistaken assumptions about what constitutes a "natural" system and promotes erroneously conservative management targets (Jones et al. 2020).

Many of the environmental archives used to establish conservation baselines consist of physical objects that provide evidence of past conditions, such as zooarchaeological and fossil records, biological and geochemical proxy archives from sediment or ice cores, and dendroclimatological records. Such archives can reveal conservation-relevant insights from the long period of prehistoric human interactions with biodiversity, and also from ancient biodiversity responses to climatic change and other stressors through deep time (Kiessling et al. 2019, Pimiento and Antonelli 2022). However, these object-based archives lack an associated recorded human narrative, which can provide further unique and invaluable insights into the drivers, dynamics, sustainability, and contexts of past human interactions with biodiversity.

Object-based archives contrast with a second type of environmental archive: written documents and associated human-produced media that constitute primary source materials for understanding or reconstructing biodiversity histories. Incorporation of historical documents into conservation research and planning has usually involved the use of archives with a primary biological focus, including naturalist and traveler accounts, exploitation and trade documents such as fisheries and whaling records and terrestrial hunting and bounty records, and museum 'extended specimen' metadata (Lovegrove 2007, Boakes et al. 2010, McClenachan et al. 2012, 2015, Webster 2017, Letessier et al. 2023). Such archives usually refer to comparable biological units to those used by modern ecologists (e.g., the same species identities and names), include relevant spatiotemporal information, and often contain direct quantitative metrics on historical baselines (e.g., catch landing records, fish body sizes; Cardinale et al. 2009, Kittinger et al. 2014, Thurstan et al. 2015). Methods have also been developed to standardize and incorporate such historical records into comparative quantitative baselines (Fortibuoni et al. 2010, Gotelli et al. 2021). They can therefore provide a relatively accessible resource that enables direct comparison of past and present states for the biological dimensions of social–ecological systems (e.g., species decline and loss, biomass change) within the same analytical frameworks.

The spatial coverage of written archives with a primary biological focus is potentially global. Some of these records can provide information on exploited species from several hundred years ago (sixteenth–seventeenth centuries CE; Pohja-Mykrä et al. 2005, Sáenz-Arroyo et al. 2005, McClenachan et al. 2006, Eddy et al. 2010, Raye 2023), corresponding to the postmedieval early modern historical period (start of sixteenth century to start of nineteenth century). However, the majority date from the modern period (from the nineteenth century onward) and are associated with the onset of modern practices of intensive resource exploitation (figure 1). For example, a meta-analysis of more than 200 historical ecology studies has shown that about 75% use only nineteenth or twentieth century written or other archives, and only about 5% incorporate textual baselines predating the eighteenth century (Beller et al. 2020). Such data provide important past baselines to measure the biodiversity impact and legacy of modern extractive industries such as commercial fisheries (Bonebrake et al. 2010, McClenachan et al. 2012) but do not provide insights into older human–environment interactions and biodiversity change.

Conservation researchers have sometimes also used other categories of written archives that do not have a primary biological focus, but were instead recorded for other reasons by reporters who were not primary natural resource users or biodiversity experts (Tomscha et al. 2016). For example, local gazetteers or *difangzhi* from China documented demographic and economic data on human populations at the county or municipality level for governance and taxation purposes, but also contain considerable information on local environmental conditions and records of locally significant wild animals (Coggins 2003, Elvin 2004). This archive has been used to reconstruct human–wildlife interactions and the spatiotemporal patterns of past distribution and decline for conservation-priority species such as gibbons across China's late Imperial and post-Imperial periods (c. 1600 CE onward; Turvey et al. 2015). The biodiversity content of other early modern-era census and survey archives has also been investigated for other regions (Viana et al. 2022).

However, many other older textual archives also exist, which have not traditionally been recognised as ecological data sources by conservation biologists, but which also contain substantial information on past biodiversity states, human–environment interactions, the intersection between people and nature, and other

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Figure 1. Left: Different specimen-based and document-based environmental archives that can provide conservation-relevant historical baselines, and their approximate temporal ranges across the past two millennia. Column width indicates relative abundance of different archive types across time. Right: "Adam Naming the Animals" (England, unknown illustrator, c. 1250–1260 CE), image from a medieval illuminated manuscript that demonstrates detailed contemporary European knowledge of many local and exotic animal species. Digital image: Courtesy of Getty's Open Content Program.

conservation-relevant topics and questions that may be unavailable elsewhere. A wide range of sources are available, including documents and records that refer to past landscapes, such as land charters, hunting manuals and old place names; other legal documents, such as parliamentary and civic records; and literary, cultural, and personal texts, such as chronicles and bestiaries (table 1).

In comparison with archives from the modern and early modern periods, which are potentially available across all global regions from which colonial-era and later records are available, these alternative source materials are geographically restricted to regions that have long local histories of literacy and writing. Such regions include Europe and the circum-Mediterranean region, and southern and eastern Asia. However, they typically have older temporal coverage (figure 1). Importantly, they can provide information from much of the pre-modern period (dating from before 1500 CE, and corresponding to the European medieval period), with European records potentially available from approximately the eighth to the sixteenth centuries CE. Records can also sometimes be regionally available from much earlier contexts, such as classical Roman and Greek and ancient Egyptian, Chinese, and Indian texts (Jennison 1937, Toynbee 1973, Strassberg 2002, Elvin 2004, Mynott 2018, Romilio 2021). Although the modern and pre-modern periods span the transition from "traditional" pre-industrial to post-industrial landscape and resource use, which was accompanied by major ecological impacts (e.g., Fuller et al. 2017), the longer time period covered by pre-modern records experienced further major environmental changes across many biomes (Aberth 2013, Hoffmann 2014), with important relevance for modern conservation thinking and planning (Szabó and Hédl 2011). For example, this period included shifts and escalations in human-caused conversion of natural habitats and exploitation of terrestrial, freshwater, and marine resources, and substantial accompanying biodiversity loss (Turvey 2009, Crees et al. 2016, Locker 2018). Pre-modern archives therefore have the potential to provide a unique window into older ecological baselines and human pressures on their environment across this long view of history, and the former human perspectives and interactions with biodiversity that have led to our current relationships with nature.

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Table 1. Main categories of pre-modern written archives not traditionally used as conservation-relevant data sources but that can contain information on past biodiversity states and human–environmental interactions.

Category	Examples	Conservation-relevant information
Landscape-related documents and records	Land charters, forest laws, hunting manuals and limitations, maps, place names	Regional occurrence of habitat types and key hunted or other noteworthy species Human interactions with natural landscapes
Other legal documents	Royal papers, parliamentary acts and records, legal acts (e.g., sumptuary laws), civic records (e.g., church, manorial and cadastral records), natural resources rents, port records and customs accounts, wills and testaments	Human–wildlife interactions, including protection of high-value or rare species and control of low-value species Exploitation, trade, circulation and inheritance of wildlife products or environmental resources
Literary, cultural, and personal documents	Historical chronicles, literary texts, bestiaries, art, letters, diaries, commonplace books	Regional occurrence and human interactions with / perceptions of natural landscapes and noteworthy species

Conservation insights from pre-modern archives

Pre-modern written sources can provide novel information on past environmental baselines for social–ecological systems, including species occurrences and distributions, landscape states, and spatiotemporal change in wildlife populations and ecological conditions. Frequent written records (e.g., chronicles, maps, parliamentary acts) that postdate known local zooarchaeological or fossil remains are available for several extirpated species across Britain and other regions, providing new evidence of varying persistence in different landscapes through time. For example, "*Pais Dinogad*", a seventh century CE poem written in Cumbric (an extinct Brittonic language), mentions a hunted animal named *llewyn* that is interpreted as the most recent British record of lynx (*Lynx lynx*; Hetherington et al. 2006). Other cultural evidence for this species' relatively late survival in Britain includes the place name of Lostford ("ford of the lynx") in Shropshire, a possible depiction in a hunting scene on a ninth century Hebridean stone cross, and a sixteenth century reference to wild "lions" in Scotland (O'Connor and Sykes 2010). Similarly, whereas postglacial remains of wolves (*Canis lupus*) are relatively uncommon in late Holocene contexts in Britain, written archives provide extensive evidence of the species' past occurrence and its progressive local extirpation through opportunistic hunting and systematic persecution as vermin, together with the changes in landscape management and shifts in human–environment relationships that drove this increased persecution (e.g., medieval mandates to destroy predators in managed royal forests associated with bounty schemes; O'Connor and Sykes 2010). Pre-modern written sources also often provide the only evidence of former local occurrence of other regionally extirpated species such as beaver (*Castor fiber*), which are now the focus of restoration efforts that require evidence on past distribution to guide planning (Manning et al. 2014, Raye 2015, Coles 2019).

Detailed cultural histories, interactions, exploitation, and uses are recorded for many animal and plant species, often associated with information on local occurrence and ecology. Many pre-modern archives also provide direct or tangential descriptions of contemporary natural and human-caused landscape change (e.g., forest clearance, wetland drainage) and other anthropogenic manipulation and modification of biodiversity (e.g., transportation and introduction of non-native species; Rackham 1980, 1986, 2001, Aberth 2013, Hoffmann 2014). For example, a comprehensive account of the medieval European fish fauna and its uses was compiled by the twelfth century Christian mystic Hildegard of Bingen, including information about 37 named taxa (Moulinier 1993, Hoffmann 2023). Other pre-modern sources document changing consumption patterns of fish species across Europe, with value, status, and prestige reflecting local abundance or rarity, as well as deliberate introductions of several freshwater species, including cyprinid fish and crayfish, widely outside their native ranges (Dyer 1988, Holdich et al. 2009, Woolgar 2016, Locker 2018, Maccarinelli 2021). Evaluating how pre-modern European exploitation of freshwater fish populations became increasingly unsustainable also requires an understanding of contemporary written records, which document historical sociocultural factors such as the ideological taboos on eating meat in early medieval Christianity that encouraged people to eat fish for approximately 35% of the year (Hoffmann 2005, 2023).

These written archives also provide unique insights into the human dimensions of historical landscapes, which must also be recognized as integral components of past social–ecological systems (Szabó and Hédl 2011). These dimensions include documenting past patterns of environmental awareness and attitudes, and how differing value systems were associated with differing human–wildlife and human–landscape interactions; the sustainability of varying human perspectives in relation to maintenance of local biodiversity and natural resources; how these factors varied across ecological and social contexts; and the extent to which past meanings have shaped modern viewpoints and remain latent in today's cultural perceptions of nature. For example, what were the differing pre-modern perspectives, salience, and philosophical attitudes toward biodiversity and natural landscapes—including animals and plants, and terrestrial, freshwater and marine systems—and how did these influence people's exploitation of natural products of varying sociocultural status (Resl 2007, Hooke 2010, Epstein 2012, Kilby 2020, Arnold 2024)? How often and under what conditions did past societies recognize the possibility of species decline or extinction, did they associate biodiversity loss with human actions, and what was the duration of cultural memory of extirpated species (Ma et al. 2021, Borlik 2024)? What prompted past interventions to protect natural resources from overexploitation and how effective were they

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Figure 2. What insights for modern-day conservation can be provided through understanding human–environmental dynamics associated with medieval English forest laws and their long-term ecological and social consequences? Image: "Livre de la Chasse" by Gaston Phoebus (1387–1389 CE).

(e.g., through top-down enforcement versus local-scale behavior change), which pro-environmental attitudes or activities led to increased sustainability of human–environment interactions, and which factors and motivations promoted coexistence with biodiversity (Coates 1998, Pohja-Mykrä et al. 2005, Aberth 2013, Dowling and Keyser 2020)? Crucially, historical archives span multicentury timescales, and so have the unique capacity to reveal the long-term consequences of different environmental behaviors, attitudes, and management actions, and biodiversity responses through time to changing human relationships with nature. Because pre-modern European landscapes typically supported rural communities that were closely dependent on natural resources for subsistence and trade (Aberth 2013, Hoffmann 2014), understanding the drivers, dynamics, and outcomes of past human–environment relationships can also provide novel predictive insights for conservation engagement with socioeconomically comparable human communities that interact with threatened biodiversity across many parts of the world today (Berkes 2018, Miller et al. 2023).

For example, from Norman times (eleventh century CE) onward, English forest laws protected deer and other quarry (*venison*) and their habitat (*vert*) for exclusive hunting by the nobility, and greatly restricted landscape use for rural communities (figure 2). However, poaching was prevalent, reflecting economic necessity and an unwillingness by many local resource users to accept regulations that considered wild animals to be the exclusive possession of the gentry (Manning 1993, Baker et al. 2015). What insights for modern-day conservation can be provided through understanding the long-term ecological and social consequences of pre-modern forest laws, such as their effectiveness for maintaining wild animal populations, the possibility of equitable management and mitigation of local tensions arising from a 'fortress conservation' model of top-down enforcement, and the dynamics of black market trade in wildlife products? Consideration of pre-modern human–environment relationships such as these from a modern ecological perspective has the potential to provide considerable new evidence about conservation effectiveness and pathways to sustainability.

Cross-disciplinary barriers to conservation integration

Although pre-modern documentary source materials have huge potential to inform conservation planning in modern-day systems, their direct incorporation is hindered by both conceptual and logistical barriers (Thorpe et al. 2017). As well as geographic restriction to regions with long local written archives, they share the known reporting errors and biases that are also present in more recent documentary archives (McClenachan et al. 2015, Tomscha et al. 2016, Pooley 2018) and in object-based archives (Crees et al. 2019), such as varying taxonomic and temporal representation that can be challenging to understand. For example, a study of historical accounts of human–tiger encounters in southern China from the first century CE onward shows a relatively low level of early reports followed by a dramatic increase in the sixteenth and seventeenth centuries (Coggins 2010). However, this pattern is interpreted as reflecting temporal variation in reporting rather than a genuine increase in tiger attacks; record keeping of political incidents increased during the period of social unrest in the late Ming dynasty, and "disharmonies" such as tiger attacks were regarded as having political significance

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Figure 3. "A Pelican Feeding Her Young" (France, unknown illustrator, c. 1270 CE). Pelicans are mentioned frequently in medieval European writings because of their incorporation into Christian religious iconography. The widespread use of pelicans as a religious symbol presents a barrier to straightforward interpretation of historical references to pelicans as a past biodiversity baseline. Digital image: Courtesy of Getty's Open Content Program.

under China's cosmo-magical Mandate of Heaven. Past and present data also typically exhibit differences in temporal and spatial resolution (Szabó and Hédl 2011), representing the "epistemological gap" of Kemp (1999). Other barriers can be more nuanced. For instance, many pre-modern records were commissioned by or dedicated to particular high-status individuals, or were copied or translated with accompanying deliberate or accidental textual changes. They typically also lack quantitative metrics of historical biodiversity states such as harvest levels of exploited species, or useful spatiotemporal information about faunas or environmental conditions other than that provided by a document's own known history, which may not reflect the events it describes.

Animals were also often referenced in pre-modern texts within figurative, emblematic, allegorical, or morally instructive rather than naturalistic contexts, and were associated with imaginary or erroneous ecologies and behaviors (Strickland 2016). For example, the chivalric romance *Sir Gawain and the Green Knight*, which was written in the Cheshire region of England in c. 1380 CE, contains a detailed description of a wild boar hunt. This is of interest to ecologists, because boar were probably extinct in the wild in Britain by the fourteenth century CE; however, the description might instead refer to a locally reintroduced boar population that was managed for hunting, or alternately may reflect a French cultural influence also evident in the poem's structure and conventions, rather than referencing events that could have occurred in contemporary Britain (Putter 1997, O'Connor and Sykes 2010, Putter and Stokes 2014).

Similarly, medieval bestiaries, one of the most popular illuminated book types in northern Europe in the twelfth and thirteenth centuries CE, portrayed a compendium of both European and exotic animals, primarily to illustrate theological concepts within Christian cosmology using animal allegories (White 1954, Morrison 2019). As a result, efforts to identify possible pre-modern records of many species are clouded by their past use as religious symbols. For example, Dalmatian pelicans (*Pelecanus crispus*) formerly occurred in Britain and northwest Europe, but there is no secure fossil or zooarchaeological evidence of their regional persistence after the Roman period, with uncertainty over their extinction timing making it difficult to determine whether their disappearance was caused by overhunting or wetland drainage; this has important implications for the current debate over whether to restore the species to its former range. Pelicans are mentioned frequently in pre-modern European writings, but this represents their use in Christian religious iconography, based on the classical misperception that the mother bird pierced its chest and revived its dead chicks with its blood. Pre-modern written records of pelicans in Europe therefore cannot necessarily be interpreted as reflecting the existence of local pelican populations (figure 3; Crees et al. 2023).

More confusingly, even straightforward species identification in pre-modern written texts or graphical depictions can be

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impeded by the use of differing historical or vernacular names, and by artists drawing animals from memory or indirect description or employing non-naturalistic artistic conventions (Crane 2013, Strickland 2016, Trachsler 2021, Videen 2023). For instance, was an equid referred to as *zebro* from thirteenth century CE Portugal and sixteenth century CE Spain in fact a late-surviving European wild ass (*Equus hydruntinus*), which is otherwise known only from much older fossil and zooarchaeological remains (Antunes 2006)? Early taxonomies may not even refer to the same biological entities as those recognized in post-Enlightenment scientific taxonomies, with pre-modern commentators potentially differentiating locally occurring biodiversity into alternative classificatory frameworks. In a comparable manner to many Indigenous ethnotaxonomies (Alves and Albuquerque 2018), pre-modern animal types might be 'lumped' or 'split' into broader or finer nomenclatural categories compared with modern species concepts, or assigned to alternative groupings of unrelated organisms (e.g., Old English *wyrm*, which included snakes, slowworms, spiders, and parasites, as well as mythical beasts such as dragons; Steele 1893, Millard 2021). Many animal accounts are also heavily embellished or entirely fabulous, with real and imaginary creatures often reported from similar archival contexts, raising potentially intractable problems for interpretation by modern scholars (White 1954, Friedman 2000, Dendle 2006, Morrison 2019).

Other challenges to reconstructing pre-modern knowledge of the natural world are more practical. The great majority of pre-modern archives have not yet been digitized (precluding the use of automated machine-learning approaches to analyze their content), and many archives also lack catalogues or any centralized information repository, making identification and access to documents that may contain environmental or conservation-relevant information a complex task. Written documents often contain historical dialectical differences and lacked a standard formal orthographical system, meaning that the same word can appear in many different forms (e.g., "boar" in Middle English can be spelled *bor*, *bore*, *bar*, *bare*, or *bayre*, and ermine fur in Scots and early Middle English can be *letis*, *lettesi*, *letwis*, *lettus*, *letys*, *letvis*, *letuis*, *lettous*, or *lateis*). British archives alone may also be written in Latin, Anglo-Norman, Old or Middle English, Old or Middle Welsh, Older Scots, or other extinct languages. Readers therefore need linguistic and palaeographical training, and analyzing these records requires a highly specialized approach (Hooke 2024).

Collaborating to understand conservation-relevant baselines

The rich body of pre-modern archival material has much to tell us, directly or implicitly, about changing biodiversity states and human interactions with nature in geographic regions with long written histories. We recognize the idea that nonstandard textual and other document-based archives (including records from before 1500 CE) can contain important environmental information, with potential relevance for modern conservation, is not new (e.g., Forman and Godron 1986). The discipline of environmental history is based on the use of historical documentation to examine human relationships and interactions with the natural world over time, and the integration of pre-modern baselines within some areas of environmental policy has led to practical evidence-based change, such as increased recognition, protection, and appropriate management of ancient woodlands in Britain through the pioneering work of Rackham (1980, 1986, 2001, Rotherham and Moody 2024). Overall, however, nearly all historical archives that have been used to make recommendations for woodland and forestry management in Europe and North America date from the last 200 years (Beller et al. 2020). Similarly, although the conservation potential of many different document-based archival materials (e.g., art; Tribot et al. 2022) is increasingly recognized, these still usually consider only relatively recent data from the modern or pre-modern periods. Conversely, older environmental documentary records are instead typically studied by humanities researchers from a literary-critical or historical perspective. Although this research might recognize specific animal-related, environmental, or ecocritical themes and case studies, their significance for modern conservation is not necessarily recognized. These older archival sources cannot easily be assessed at face value by conservationists because of the reasons outlined above, and have still rarely been investigated in relation to current conservation needs and approaches.

Frameworks are now available to guide how different types of evidence can be used in different steps of conservation practice, and these should also be used to promote the application of historical evidence (e.g., Salafsky et al. 2019). Practical incorporation of environmental archives in conservation remains limited due to a continued lack of recognition of the information-content, value, and utility of historical ecology by much of the modern conservation community (Bonebrake et al. 2010, Smith et al. 2018, Dietl et al. 2019, Groff et al. 2023). However, even existing research derived from modern ecological studies is often unused by conservation professionals when making management and policy decisions, leading to a widespread research–implementation (or "knowing–doing") gap that extends far beyond just overlooking environmental archives (Knight et al. 2008, Cook et al. 2010, 2013, Walsh et al. 2015). In particular, poor direct communication and collaboration between researchers and practitioners is identified as a key barrier to effective use of evidence in conservation (Walsh et al. 2019). The application of historical sources to conservation therefore ultimately requires not only relevant applied research to understand past biodiversity states and change, but also active engagement with actors within the conservation sector to integrate past data into real-world decision-making and setting of new management directions.

Although the use of historical data in environmental science and management has many challenges (McClenachan et al. 2015, Clavero et al. 2022), it is recognized that most barriers result from incomplete communication or miscommunication between ecologists and historians (Szabó and Hédl 2011). This problem has been discussed specifically by previous authors (e.g., Pooley 2013). Concerningly, though, through our extensive engagement with conservation researchers and practitioners on one hand and humanities researchers on the other, our experiences confirm that many conservationists still remain unaware of the range of environmental information types available in pre-modern historical records, the methodological barriers that exist to integrating them into modern environmental assessments, or even that such records might be of relevance to today's conservation issues.

We encourage greater communication, collaboration, and interdisciplinary research between historians, classicists, medievalists, and other scholars who are familiar with accessing and studying different types of pre-modern historical archives, and ecologists and conservation biologists who are familiar with interpreting the potential significance of faunal and environmental records that they contain. Such communication can enable scientists to become more aware of the range of conservation-relevant

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topics and insights that are available within such archives, and can enable pre-modern scholars to better understand what conservation biologists and practitioners want to know (in terms of existing priorities and relevance; cf. Sutherland et al. 2009, Jucker et al. 2018, Kiessling et al. 2019, Southgate 2019), and therefore assess how to potentially provide useful information and guide research in specific areas. However, it is important not to overlook basic barriers to effective collaboration within the increasingly siloed research sector, such as how historians and ecologists can even meet and identify shared interests and priorities. We further recommend the development of formal networks (e.g., regular themed workshops) to support direct knowledge-sharing and mutual engagement in this field—for example, using the recently established Conservation Paleobiology Network (https://conservationpaleorcn.org) as a template to explore successful ways to bring stakeholders together and communicate historical data across disciplinary divides. We hope that such efforts will lead to identification of shared research opportunities and goals, new collaborative interdisciplinary research programs with well-defined pathways to practical conservation impact, and co-production of new resources (e.g., databases).

Environmental history has the capacity to provide new predictive insights for conservation and to identify unique solutions to current problems. By highlighting the contemporary conservation uses that can be provided by pre-modern documentary archives—whether quantitative, qualitative, or narrative "anecdata" in content—we aim to start a new discussion between knowledge owners and knowledge users that we hope will lead to greater mutual awareness and shared research goals and outputs. In doing so, we hope to enable these novel information sources to be integrated with other archival biodiversity evidence to establish a more comprehensive understanding of past states and change. Although incorporating environmental lessons from pre-modern archives requires caution and context, these underused resources have the potential to represent a key component of the diverse modern conservation toolkit.

Acknowledgments

We are grateful for the thought-provoking discussions with colleagues from across the humanities and environmental sectors at two workshops in April and November 2023, which were supported by a NERC Cross-Disciplinary Research Grant. STT's work is supported by Research England.

Author contributions

Samuel T. Turvey (Conceptualization, Investigation, Project administration, Resources, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing), and Kate McClune (Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Validation, Writing - original draft, Writing - review & editing)

Data availability

No new data were generated or analysed in support of this research.

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Received: May 2, 2024. **Revised:** October 22, 2024. **Accepted:** November 22, 2024
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